

**OFFICE OF
MANNED SPACE
FLIGHT**

APOLLO APPLICATIONS PROGRAM

PROGRAM DIRECTIVE NO. 14-A

FLIGHT MISSION DIRECTIVE

FOR

AAP-3A



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON D. C. 20546

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APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 14A

TO : Distribution

FROM:

John H. Disher for
DIRECTOR, APOLLO APPLICATIONS PROGRAM

SUBJECT: Flight Mission Directive for Mission AAP-3A

- REF : (a) MSF Schedule Volume I, Level I Schedule Summary
(Latest Edition)
(b) Apollo Applications Flight Mission Assignments Directive,
M-D ML 3200.056, dated February 1969
(c) Apollo Applications Test Requirements Document, NHB 8080.3,
dated October 13, 1967
(d) Apollo Applications Program Directive No. 11 dated
February 26, 1968
(e) Apollo Program Directive No. 15 dated January 25, 1966
(f) Reliability and Quality Assurance Plan, NHB 5300.5,
dated May 1967

PURPOSE: This directive defines AAP requirements and responsibilities to initiate those actions prerequisite to execution of the AAP-3A Mission. Commitment of funds or technical effort associated with implementation of this directive must be in accordance with authorization provided by NASA Project Approval Documents. The mission will utilize the launch vehicles and spacecraft and be scheduled for launch as indicated in reference (a). This directive supersedes Apollo Applications Program Directive No. 14 dated May 22, 1968.

1.0 MISSION PURPOSE

The purposes of the AAP-3A Mission consistent with reference (b) are as follows:

- a. Qualify man, evaluate his support requirements and determine human task performance capabilities on long duration manned space flight missions.
- b. Demonstrate feasibility of:
 - (1) reactivating a Saturn I Workshop that has been left in earth orbit for several months, and

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- (2) reusing a Saturn I Workshop as a base of operations for the conduct of experiments in astronomy, science, applications, technology, engineering and medicine.
- c. Obtain data on operations and system performance to support future earth orbital space station systems design and operations.

2.0 MISSION OBJECTIVES

- 2.1 Primary Objectives: The primary objectives of the AAP-3A Mission are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.
- a. Obtain data to evaluate space flight environmental effects on the crew of a mission duration of up to 56 days (Experiments M071, M072R, M073R, M091R, M111R, M113R, M171R).
 - b. Demonstrate feasibility of reactivating and operating the Saturn I Workshop (Experiment M402R and elements of M487R) as a habitable space structure for a period up to 56 days from the AAP-3A launch date through evaluation of the orbital assembly consisting of the CSM/S-IVB/Airlock/Multiple Docking Adapter to include the following:
 - (1) subsystems performance, and
 - (2) astronaut mobility and work capability in both intra- and extra-vehicular activity.
- 2.2 Secondary Objectives: The secondary objectives of Mission AAP-3A are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules.
- a. Demonstrate the feasibility of reusing experiments hardware left stored in the orbital assembly from the AAP-1/AAP-2 Mission.
 - b. Obtain engineering and technological data needed for development of advanced space vehicles and equipment (Experiments M487R, D021RC, D022RC, D024RC, T018 and candidate experiments M507R, M508RC, M509RC, M512RC, D019R, D020R, T020RC, T025R, T027R).

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- c. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (candidate Experiment S101R).
- d. Obtain medical and biological data as required for evaluation of the effects of prolonged weightlessness on man (Experiments MO74R, MO93R, M131R, M151R, M172R).
- e. Obtain data in the areas of bioscience and astronomy (Experiments SO09RC, SO71, SO72 and candidate experiments SO18R, SO19R, SO20R, SO63R, SO73R).
- f. Verify the ability of mission ground support systems to support mission activities of extended duration.
- g. Leave the Saturn I Workshop in orbit for future reactivation and reuse.

3.0 GENERAL FLIGHT PLAN

- 3.1 Launch: AAP-3A is a manned flight involving a Saturn IB launch vehicle, a modified Apollo Block II CSM and provisions as needed to sustain a 56-day mission. It will be launched from LC 34 at KSC at a time and azimuth to facilitate rendezvous with the Saturn I Workshop left in orbit from the AAP-1/AAP-2 Mission. The CSM will be inserted into an approximate 80 x 120 n. mi. orbit using both launch vehicle and spacecraft service module propulsion.
- 3.2 Spacecraft Flight Profile: After performing a phasing orbit transfer, the CSM will rendezvous with the Saturn I Workshop. The spacecraft will hard dock to the axial port of the Multiple Docking Adapter and the mission will continue on an open-ended basis for up to 56 days with primary emphasis in the experiment area directed toward attainment of medical data associated with long term crew exposure to the zero G environment. At the conclusion of the mission, the CM will return to earth using the Service Module SPS to provide the primary deorbit impulse. The SM Reaction Control System will be utilized as a backup system for deorbit.
- 3.3 Recovery: Water recovery to be developed consistent with the above-stated profile characteristics and the normal recovery constraints associated with the deployment of recovery forces and the local lighting conditions at the time of recovery.

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- 3.4 Mission Support Requirements: These requirements will be identified and provided in documentation as specified in the Manned Space Flight Support Requirements Documentation Manual. This documentation is under the overall cognizance of the Operations Support Requirements Office (OSRO), Mission Operations, OMSF, and is published normally not later than four months prior to launch.

4.0 CONFIGURATION

- 4.1 Launch Vehicle: A Saturn IB launch vehicle as assigned by reference (a) will be used for the AAP-3A flight. Modifications will be limited to the minimum necessary to achieve proper trajectory stabilization and control.
- 4.2 Spacecraft: The AAP-3A spacecraft will be an Apollo Block II CSM modified to:
- a. operate with the Airlock and hard dock to the MDA as dictated by mission requirements,
 - b. carry and support experiment hardware as required,
 - c. incorporate resupply provisions in addition to those remaining from AAP-1/AAP-2 as needed to sustain a 56-day mission,
 - d. provide an extended capability Service Module Reaction Control System (RCS) as required to accomplish mission objectives,
 - e. provide for use of the SM RCS for backup deorbit,
 - f. provide a control system for cluster reactivation and regulation of the two-gas life support system,
 - g. incorporate 56-day fuel cells,
 - h. provide cryogenic consumables to support fuel cell power generation and two gas atmosphere for a 56-day mission,
 - i. provide for power transfer between the CSM and the Airlock power distribution system,
 - j. permit utilization of the CM communications system as a cluster voice communications center, and
 - k. provide capability for utilization of SM main propulsion system for orbit insertion.

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5.0 EXPERIMENTS

The following experiments are assigned to the AAP-3A Mission.

<u>Objective</u>	<u>Exp. No.*</u>	<u>Title</u>	<u>Dev. Center</u>	<u>Launch Location</u>
P	M402R	Orbital Workshop	MSFC	--
S**	M487R	Habitability/Crew Quarters	MSFC	--
P	M071 (M052)	Mineral Balance	MSC	CM
P	M072R (M052)	Bone Densitometry (Pre & Post Flight)	MSC	--
P	M073R (M052)	Bioassay of Body Fluids	MSC	CM
S	M074R (M056)	Specimen Mass Measurement	MSC	CM
P	M091R (M051)	Lower Body Negative Pressure (Pre & Post Flight)	MSC	--
P	M092R (M051)	Inflight Lower Body Negative Pressure	MSC	--
S	M093R (M018)	Vectorcardiogram	MSC	CM
P	M111R (M051)	Cytogenetic Studies of Blood (Pre & Post Flight)	MSC	--
P	M113R	Blood Volume & Red Cell Life Span (Pre & Post Flight)	MSC	--
S	M131R (M053)	Human Vestibular Function	MSC	CM
S	M151R (M055)	Time & Motion Study	MSC	CM
P	M171R (M050)	Metabolic Activity	MSC	CM
S	M172R (M058)	Body Mass Measurement	MSC	--
S	D021RC	Expandable Airlock Technology	AF/MSFC	--
S	D022RC	Expandable Structures for Recovery	AF/MSFC	--
S	D024RC	Thermal Control Coatings	AF/MSFC	--
S	S071	Circadian Rhythm-Pocket Mice	ARC	SM
S	S072	Circadian Rhythm-Vinegar Fly	ARC	SM
S	S009RC	Nuclear Emulsion	MSC	--
S	T018	Precision Optical Tracking	MSFC	IU

*R - Designates experiment was performed on AAP-1/AAP-2 Mission and is scheduled for reactivation and reuse on AAP-3A. Only those elements of hardware prerequisite to repetition will be transported to orbit.

RC - Designates experiment was initiated on AAP-1/AAP-2 Mission and is scheduled for completion on AAP-3A.

** - Elements of this experiment vital to accomplishment of this mission are to be considered primary objectives.

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The following experiments are under review as candidates for reactivation on AAP-3A.

D019R	Suit Donning and Sleep Station Evaluation
D020R	Alternate Restraints Evaluation
M512RC*	Materials Processing In Space
M507R	Gravity Substitute Work Bench
M508RC	EVA Hardware Evaluation
M509RC	Astronaut Maneuvering Equipment
S018R	Micrometeorite Collection
S019R	UV Stellar Astronomy
S020R	UV/X-ray Solar Photography
S063R	UV Airglow Horizon Photography
S073R	Gegenschein/Zodiacal Light
S101R	Multiband Photography
T020RC	Foot Controlled Maneuvering Unit
T025R	Coronagraph Contamination Measurement
T027R	ATM Contamination Measurement

- * M492R, Tube Joining Assemblies and M493R, Electron Beam Welding have been combined into M512RC.

5.1 Implementation: The following instructions are established for development, payload integration and mission planning activities associated with the assigned experiments.

- a. Within currently authorized funding authority, develop all new experiments and procure necessary replacement flight hardware for those experiments which were carried and/or performed on the AAP-1/AAP-2 Mission and are scheduled for repeat or completion on AAP-3A.
- b. Integrate all new experiments assigned to AAP-3A and all experiment hardware which is required for reuse or completion of experiments carried on AAP-1 and AAP-2.
- c. Integrate the return payload portion of all experiments assigned for performance or completion on AAP-3A.
- d. Conduct mission planning for all experiments assigned to AAP-3A.
- e. All new experiments and experiment hardware required for reuse or completion of experiments carried on AAP-1 and AAP-2 should be developed and delivered on a schedule which will provide flight hardware for installation in the carrier module to verify the experiment-to-carrier interface integrity. Need dates will be established and reported in reference (a).

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- f. The above experiment assignments are compatible with the official assignment of experiments in the Level I SARP Schedule (reference (a)) dated April 8, 1969. Revisions will be identified on a monthly basis in reference (a) and will be reflected in periodic revisions to this directive.

6.0 SUPPORTING GROUND TEST CONSTRAINTS

The test program will be developed in accordance with the Apollo Applications Test Requirements document (reference (c)) and appropriate test specifications. Mission Requirements documents prepared by the centers in support of these missions will identify by inclusion or reference the test constraints which must be lifted prior to mission execution.

- 6.1 Qualification: Components of the spacecraft, launch vehicle, SLA, flight experiment hardware and associated support systems whose failure would jeopardize either crew safety (Category I) or the accomplishment of a primary mission objective (Category II) and which have not been flight tested will be ground qualified and/or certified prior to launch as described in Appendix D of reference (c). Basic Apollo hardware which has been flight tested (i.e., CSM) will be subjected to additional ground qualification and/or certification tests as required to provide confidence in meeting the long duration and other pertinent AAP requirements.
- 6.2 Launch Vehicles: The following flight stage tests will be performed on the AAP-3A launch vehicle.
- Manufacturing checkout of the IU, S-IB and S-IVB flight stages.
 - Static test of the S-IB and S-IVB flight stages.
 - Post static checkout of the S-IB and S-IVB flight stages.
 - Post storage checkout of IU's, S-IB and S-IVB flight stages.
 - KSC integrated prelaunch tests of the IU, S-IB and S-IVB flight stages.
- 6.3 AAP Experiments: The following ground tests will be performed:
- Experiment development tests.
 - Qualification tests for each experiment.
 - Factory checkout and acceptance test of experiment and associated support systems.

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- d. Interface verification tests of experiment and associated support systems with carriers.
 - e. KSC prelaunch tests.
- 6.4 Spacecraft: The following major flight article ground tests will be performed on the AAP-3A CSM:
- a. Qualification and/or certification tests on the basic Apollo CSM as required to meet the long duration and other pertinent AAP mission requirements.
 - b. Qualification tests for AAP peculiar subsystems modifications to verify operation for the AAP-3A Mission.
 - c. Integrated systems tests.
 - d. Factory checkout and acceptance tests.
 - e. KSC prelaunch tests.
- 6.5 Integrated Systems Tests: Integrated systems tests will be conducted to verify that flight hardware is physically, functionally and operationally compatible with associated ground support systems and mating hardware in the cluster configuration. Cluster configuration tests will be conducted with flight articles where practicable and with flight configured prototypes, simulators or master gauges, as appropriate, when the interfacing flight article cannot reasonably be made available.
- 6.6 Prior Flight Missions: All launch vehicle and spacecraft anomalies resulting from previous missions which could degrade or interfere with primary objectives will be evaluated and corrected prior to the launch of AAP-3A.
- 6.7 Design Certification Review (DCR): An AAP DCR will be conducted to certify all new hardware and all changes from the flight hardware of the AAP-1 Mission. Hardware already certified in previous AAP-1 Mission DCR's will be recertified as required to meet AAP extended life and/or performance requirements. This review will also include certification of experiments likely to affect flight worthiness, manned flight safety and/or mission primary objectives. The DCR shall be in accordance with Apollo Applications Program Directive No. 11 (reference (d)).

- 6.8 Certification: A Certification of Flight Worthiness (reference (c)) for each stage, IU, SLA and spacecraft is required prior to shipment from the factory and after static firing if appropriate. In addition, experiments whose failure would jeopardize crew safety or the accomplishment of a primary mission objective (Category I or II) will also require preparation of a COFW. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close-out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 (reference (e)) as to be modified for AAP.

7.0 RELIABILITY AND QUALITY ASSURANCE

A Reliability and Quality Assurance Program will be developed in accordance with the Reliability and Quality Assurance Plan (reference (f)) issued by AAP, R&QA, OMSF.

8.0 RESPONSIBILITIES

Center responsibilities for planning and future implementation of this mission are as follows:

8.1 MSFC:

- a. Provide the Saturn IB launch vehicle and required vehicle and GSE modifications.
- b. Develop assigned experiments and supporting hardware.
- c. Develop GSE as required for assigned experiments.
- d. Integrate all experiments designated for transport on the AAP-3A launch vehicle.
- e. Conduct guidance and control dynamics analyses for the ground launched space vehicle configuration and develop the requisite launch vehicle guidance and control capability.

- f. Conduct overall systems engineering activities and associated mission systems equipment analysis to assure the compatibility and integrity, as an integrated system, of the AAP-3A flight hardware elements and the orbital assembly. (This does not apply to the more detailed development responsibility associated with the Command and Service Module.)
- g. Provide launch vehicle performance constraints and systems data to MSC for mission planning.
- h. Provide technical support to MSC concerning crew training procedures and flight operations planning for the Saturn I Workshop reactivation and the MSFC assigned/designated experiments.
- i. Provide operational support to MSC as required during AAP-3A flight operations.
- j. Define resupply requirements for the AM/MDA/OWS to sustain a mission of up to 56 days duration and provide technical support to MSC concerning expendables for AM/MDA/OWS resupply to be transported in the CSM.
- k. Provide test requirements which are suitable for KSC development of test procedures for MSFC end items.
- l. Provide technical support to KSC as required during the acceptance, modification, prelaunch checkout and the launch phases of this mission.

8.2 MSC:

- a. Provide the CSM and associated GSE required for the AAP-3A Mission.
- b. Define the resupply requirements and develop the hardware to sustain a mission of up to 56 days duration for the CSM.
- c. Develop assigned experiments and supporting hardware.
- d. Develop GSE as required for assigned experiments.
- e. Integrate all experiments designated for transport on the AAP-3A CSM and provide for return portions of AAP-2 experiments.
- f. Conduct analyses in the area of instrumentation and communication and ground network mission control for the orbital assembly as required for the development of the CSM revisit hardware.
- g. Plan the mission and develop the astronaut flight plan including appropriate inputs from MSFC for the Saturn I Workshop and MSFC assigned experiments.

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- h. Provide operational space suits, EVA environmental control systems and other crew equipment as required.
- i. Plan and execute flight control, experiment and recovery operations.
- j. Train the astronaut crew.
- k. Provide support to MSFC on CSM systems and operational elements as required for overall systems engineering to integrate and interface the overall stacked vehicle and the orbital assembly.
- l. Provide test requirements which are suitable for KSC development of test procedures for MSC end items and for experiments integrated in the CSM.
- m. Provide technical support to KSC as required during the prelaunch and launch phases of this mission.

8.3 KSC:

- a. Prepare checkout plans and procedures and conduct prelaunch checkout of the launch vehicle and experiment hardware with the associated GSE.
- b. Prepare checkout plans and procedures and conduct prelaunch checkout of the spacecraft and experiment hardware for AAP-3A with the associated GSE.
- c. Plan and execute space vehicle launch operations.
- d. Provide technical support as required to MSC and MSFC concerning the KSC implementation of modifications to flight hardware and GSE hardware.
- e. Prepare integrated space vehicle plans and checkout procedures and conduct integrated checkout of the space vehicle with its associated ground support systems

9.0 IMPLEMENTATION

The Mission Requirements documents for Missions AAP-1/AAP-2, AAP-3A and AAP-3/AAP-4 dated January 1969, jointly prepared by MSC and MSFC should be reviewed and updated to reflect revisions in this directive.

Subsequent changes and future revisions to center Mission Requirements documents noted above which conflict with the requirements stated herein will require coordination between the centers and the review and approval of the Apollo Applications Director. Other revisions to center Mission Requirements documents will be coordinated between centers as required with ten copies submitted to the Director, Apollo Applications, Code ML, for information.

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MM/Humphreys (2)
MMS/Mclaughlin
M-N/Alibrando
MO/Turnock
MO/Stevenson (5)
MOR/Brown (10)
MOR/Chandler
MPP/Rafel (2)
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MSR/Davis
MTD/Lord (9)
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ML/Schneider
MLD/Disher
ML-1/Levenson
MLA/Culbertson (12)
MLO/Disher (5)
MLP/Field (12)
MLP-4/Koutsandreas (5)
MLP-5/Little (3)
MLR/Cohen (5)
MLS/Hagner (7)
MLT/Savage (14)
MLV/Fero

OSSA

S/Naugle
SD/Nicks
SA/Jaffe
SB/Reynolds
SE/Johnson
SG/Mitchell
SL/Hearth
SV/Mahon

OART

RD/Lundin
RDA/Harper
RB/Jones
RE/Sullivan
RF/Ginter
RN/Woodward
RFE/Novik (5)
RP/Tischler
RV/Ames

XP/Jones (2)

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OTDAT/Truszynski
TD/Brockett
TA/Morrison
TS/Pozinsky
TR/BryantLaRC

DIR/Cortright (3)

LeRC

DIR/Silverstein (3)

OPPA

PT/Maggin

ERC

DIR/Elms (3)

GSFC110/Stroud
800/Covington
810/Roberts
820/Wood
550/VonbunARC

DIR/Mark

Martin MariettaKSC

AA/Morgan (75)

Hurtt
DavisMSC

KA/Thompson (100)

MSFCDIR/Von Braun
EX/Maus
I-DIR/O'Connor
R-DIR/Weidner
I-S/AA-MGR/Belew
I-I/IB-MGR/Teir
I-V-MGR/James
I-MO-MGR/Speer
I-RM-M/Goldston (70)